

FIRST IN A SET OF POINTED COMMENTARIES ON
MAGNETIC DATA RECORDING ... from

FERRROXCUBE

CORPORATION OF AMERICA

SAUGERTIES, NEW YORK

**ARE YOU RECORDING
WITH A HEAD
... OR A BOTTLENECK?**

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12603

1-6



This is the first in a series of six short monographs we shall be sending to you in the next few weeks. Each will examine one aspect of the impact, on magnetic data recording, of a new generation of recording heads, manufactured by the unique, patented Ferroxcube "all-glass-bonded" process.

We address these messages to you because we understand you to be directly and responsibly involved in the engineering, management, or marketing decisions that determine your company's choice of data-recording techniques and equipment. If we have misunderstood your role, and misdirected this first monograph, won't you use the enclosed card to set us straight? We'll start again, with the individual you designate, and both he and we will appreciate your courtesy.

ARE YOU RECORDING WITH A HEAD...OR A BOTTLENECK?

The way to tell is to ask yourself if your design is *significantly* limited by dimensional tolerances imposed by the recording head. If your design could be improved — or cost-reduced — by a head with a shorter gap length, shorter gap height, closer track spacing, better gap alignment (less gap scatter), or more accurate gap positioning, relative to other critical head dimensions — then, friend, you have yourself a bottleneck!

We have eliminated many such bottlenecks for recording-system designers by introducing all-glass-bonded Ferroxcube recording heads into their designs. Invariably, the Ferroxcube head more than pays for itself, and for the design effort required, by the *system* savings it creates. In flying-head applications, for example, use of a Ferroxcube head has so increased the available bit density, that fewer discs are required, access time is significantly higher, and the cost per bit is, consequently, much lower.

The key to all these improvements is *dimensional control*, one of the outstanding advantages of the all-glass-bonded technique. . .

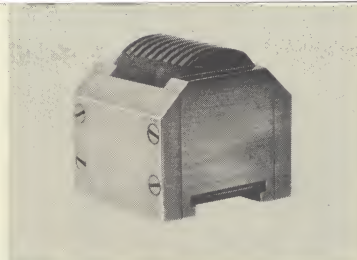


WHEN WE TALK OF GREATER DIMENSIONAL CONTROL, WE MEAN THAT every significant dimension of an all-glass-bonded magnetic recording head may be controlled to a markedly higher accuracy than is consistently achievable in any other construction. These dimensions may be controlled more accurately, and maintained at a consistently higher accuracy from head to head and from lot to lot. Further, the *minimum* dimensions achievable and controllable are *smaller* than in any other construction.

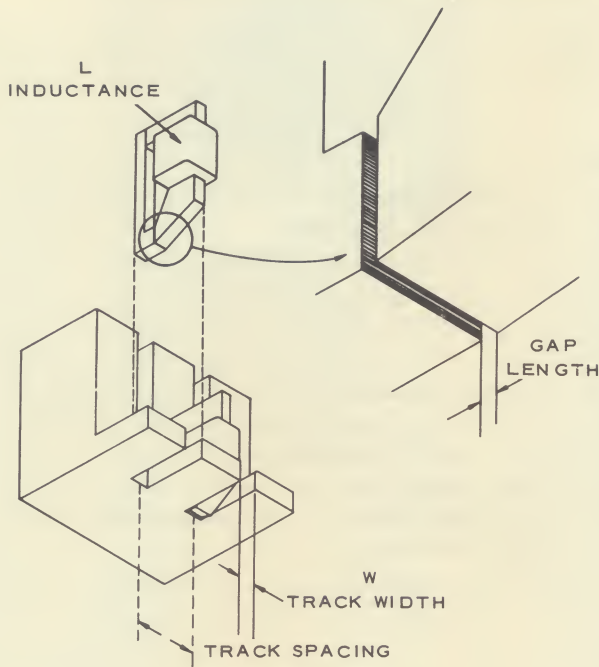


FOR EXAMPLE. . . . We were able to control the dimensions of the flying heads (shown here) for a large disc memory so accurately that the designers were able to specify a gap-length of 200 microinches and a flying distance of less than 100 microinches, making possible a packing density of almost five times that previously considered a maximum with conventional heads.

THEN THERE IS ALSO THE FAR GREATER DIMENSIONAL STABILITY OF FERROXCUBE HEADS. Not only can the dimensions of an all-glass-bonded recording head be controlled more accurately, but they exhibit comparable stability . . . thus making the greater dimensional control meaningful and useful. Because the ferrite core material used in these heads has essentially the same coefficients of expansion as the glass bonding material to which it is fused, and because the bonding process creates a single, mechanically-homogeneous structure, neither temperature nor mechanical stress, such as shock or vibration, can cause significant alteration in the critical dimensions upon which recording accuracy depends. The same thermal compatibility is maintained between the bonded core and its supporting structure.



FOR INSTANCE. . . This 7-channel Read-Write contact analog tape head has such excellent stability that no variation in either reading or writing sensitivity is observable over the entire range of "MIL-Grade" ambient conditions encompassed within the standard IRIG environmental specifications.



HERE ARE THE FUNDAMENTAL

Fundamental Dimensional Relationships.

The drawing to the left indicates the fundamental dimensions that determine the performance—and, hence, the design — of a “flying head”. Note that the relationships between these critical dimensions and the head performance are given by

$$\text{Read-out voltage} = k_1 n W$$

where n = number of turns per winding

and W = track width

$$\text{Inductance } L = k_2 n W v$$

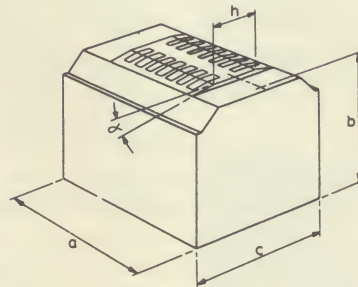
where v = velocity

$$\text{Drive } i \approx \frac{K_3 H}{n}$$

TECHNICAL RELATIONSHIPS INVOLVED ...

Read-To-Write Relationships.

As illustrated here, certain dimensions and tolerances must be applied to multiple-head assemblies in which the read/write function is provided — whether in a unit assembly, or in a pair of assemblies. Note that this set of specifications is actually derived from the basic data format planned for the system.



Head-To-Head Dimensional Relationships.

Equally as important as the fundamental head-to-medium relationships are the dimensions and tolerances that relate one head to another in a multi-head assembly. These include: head *spacing* (distance between gap centerlines); head *separation* (distance between facing magnetic surfaces of adjacent cores); track width; gap length; and, of course, at least an estimate of gap alignment requirements.

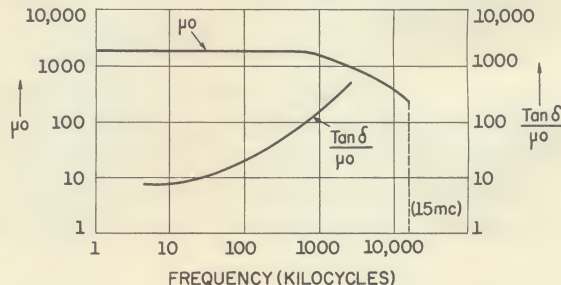
HERE'S HOW FERROXCUBE ALL-GLASS-BONDED RECORDING HEADS ARE DESIGNED AND MANUFACTURED...

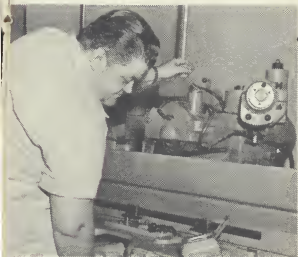
THE DESIGN may begin in either of two ways:

- You may prepare a complete electrical, magnetic, and mechanical specification, and then have us provide an equivalent all-glass-bonded design.
- You may merely state the head-to-medium spatial relationships, specify the limiting electromagnetic properties of the medium, and describe the input-output signals and interfaces. . . and let us write an equivalent specification.

FERROXCUBE 4R5 is the core material used in all-glass-bonded recording heads. It is unique in having chemical, thermal, and mechanical characteristics that are fully compatible with the special glass used to bond the head assembly; this unique formulation sacrifices very little in either its electrical or magnetic properties to achieve that compatibility, as the graph shows. These parameters are very accurately controlled.

**ALL-GLASS-BONDED
HEADS ARE MADE BY
A HIGHLY-DEVELOPED
FIVE-STEP PROCESS**



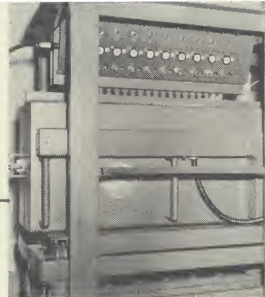


Precision Core Grinding . . . Ferroxcube ferrite facilities are unequalled anywhere in the world.

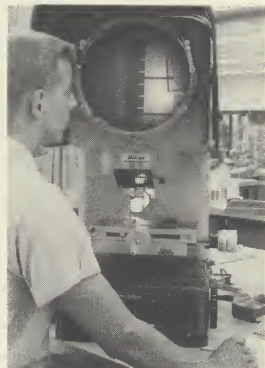
Precision Winding . . . Ferroxcube's modern winding facility employs the most modern fine-wire winding features and techniques currently available.



Quality-Assured Precision Assembly . . . Ferroxcube's new assembly line operates under the most rigid quality controls in the industry—from the ultimate security of 100% in-plant manufacture of all critical elements to the maintenance of "white-room" environments for all critical assembly operations.



Unique Glass Bonding Facility . . . Ferroxcube's all glass-bonding technique is an exclusive process.



Micro-Finish and Testing . . . Ferroxcube has developed completely new micro-finishing techniques compatible with the new higher dimensional - control standards made possible by all-glass bonding, and testing techniques, compatible with the 1.7 microinch RMS surface finish achieved on all standard heads.

IN SUMMARY, THEN, WE MAY SAY

that the specific advantages of Ferroxcube All-Glass-Bonded Recording Heads that allow them to eliminate recording system bottlenecks are:

- shorter gap length
- shorter gap height
- closer track spacing
- better gap alignment
(less gap scatter)
- more accurate gap positioning
- tighter dimensional and
electromagnetic tolerances

hence:

*more bits per track
more tracks per inch
higher bit density
more bits/dollar*

**THESE
EXAMPLES
WILL SERVE
TO ILLUSTRATE
THE RANGE
& VARIETY
OF HEADS
WE NOW
MANUFACTURE...**

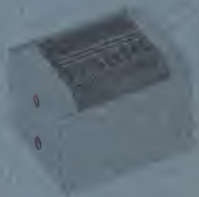


◀ 7-Channel Read-Write
Contact Analog Tape
Head.

Digital Contact Head for a
"Magnetic-Stripe-Reader"
Used in Business-Machine
Applications. ▶



◀ 7-Track Digital Head, The
standard final finish is held
to 1.7 microinches, RMS,
and this finish is main-
tained to within 2 micro-
inches over thousands of
hours of use.



8-Track Analog Head for
a Tape Transport. ▶



◀ 13-Unit Assembly of Flying
Disc File Head.



**HOW
ABOUT
YOUR
MAGNETIC
RECORDING
SYSTEMS?
ISN'T IT
TIME WE
PUT OUR
HEADS
TOGETHER...?**

Gentlemen:

I read you, loud and clear, and here's my reaction:

- ☐ I believe you have reached my boiling point—have one of your application engineering group call me for an appointment, before I build up excessive pressure.
- ☐ I'm thawing. Send over one of your fire-breathing field engineers. (Have him call for an appointment, first.)
- ☐ I'm far from convinced—hardly warm, in fact—but I can't afford to ignore all-glass-bonding any longer. Send me your brochure, and any other fuel you wish to throw on the fire.

☐ Here's my Name _____ and Title _____

my Company _____

and Division _____

Street Address _____

City, State, Zip _____

☐ You're talking to the wrong party. Try your pitch on:

Name _____ Title _____

☐ At the Above Address or ☐ At: _____

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SAUGERTIES, NEW YORK



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